SCEPS In Space - Non-Radioisotope Power Systems for Sunless Solar System Exploration Missions

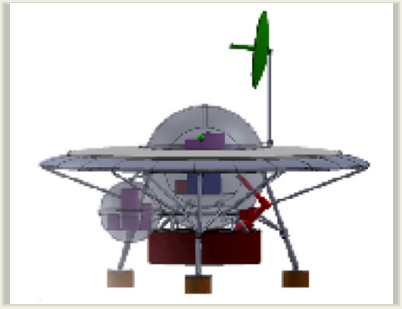
Completed Technology Project (2015 - 2017)

Project Introduction

Stored Chemical Energy Power Systems (SCEPS) have been used in U.S. Navy torpedos for decades. The Penn State Applied Research Lab proposes to continue the study of applying this robust, high-energy-density concept to exploration missions that can't be powered by sunlight. Plutonium could be used, but its scarcity leaves many targets unexplored. In the NIAC Phase II study we will mature the Venus mission studied in Phase I and expand understanding of SCEPS for other targets. Testing will be done to determine SCEPS performance using CO2 as an oxidizer (Venus' atmosphere), and the Venus mission key risk areas addressed. Venus science goals will be revisited to prepare the Venus concept for the next level of study. Also, we will engage with the leaders in science planning for small bodies (asteroids and comets), outer planets (Jupiter's and Saturn's moons), and robotic missions to our own Moon and make a determination of the first, most high-impact use of SCEPS in space.

Anticipated Benefits

We see an opportunity to expand our understanding of the impact that SCEPS could have on solar system exploration. The hot, sunless environment of Venus may indeed be explored through the use of SCEPS for energy storage and power generation, but many cold, sunless or sun-poor regions may also benefit. Sending a self-contained (no in situ resource utilization) SCEPS system to power a lander on the airless, icy surface of Europa or the exotic lakes or dunes of Titan may return substantial science that would be otherwise left unknown, or at least greatly delayed as the community works to solve the Plutonium-availability problem. Though there is work to be done to learn if SCEPS can be used to serve exploration systems, the impact of successful scaling would be profound. In Phase II we seek to expand the understanding of how best to target this technology and plan a path for development.



Artist depiction of Stored Chemical Energy Power Systems

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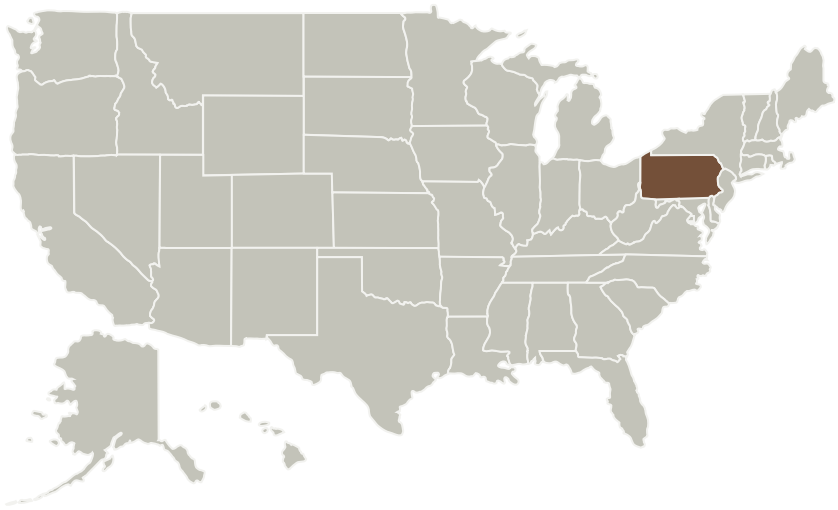
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Pennsylvania State University-Main Campus(Penn State)	Lead Organization	Academia	University Park, Pennsylvania

Primary U.S. Work Locations
Pennsylvania

Project Transitions

July 2015: Project Start

June 2017: Closed out

Closeout Link: https://www.nasa.gov/feature/sceps-in-space-non-radioisotope-power-systems-for-sunless-solar-system-exploration-missions

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Pennsylvania State University-Main Campus (Penn State)

Responsible Program:

NASA Innovative Advanced Concepts

Project Management

Program Director:

Jason E Derleth

Program Manager:

Eric A Eberly

Principal Investigator:

Michael S Paul

Co-Investigators:

Sonny Harman
Timothy J Miller

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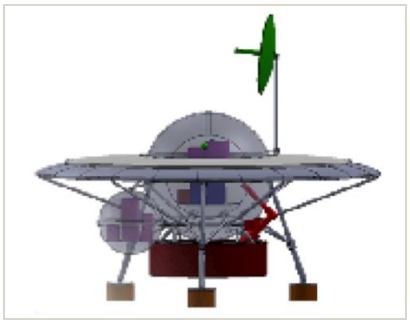
Images



Project Image
Artist depiction of Stored Chemical Energy Power Systems
(https://techport.nasa.gov/image/102302)

Links

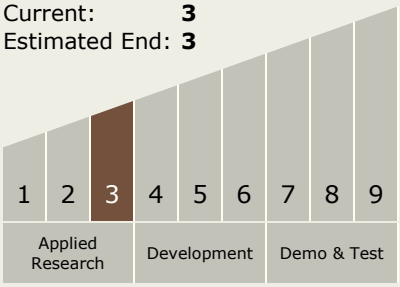
NASA.gov Feature Article
(https://www.nasa.gov/feature/sceps-in-space-non-radioisotope-power-systems-for-sunless-solar-system-exploration-missions)

Project Website:

https://www.nasa.gov/directorates/spacetech/home/index.html

Technology Maturity (TRL)

Start: **3**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX04 Robotic Systems
  - TX04.2 Mobility
    - TX04.2.1 Below-Surface Mobility

Target Destinations

Mars, Outside the Solar System